# SYNOPSIS

TITLE OF PROPOSED RESEARCH WORK

# PETRO-PALYNOLOGICAL STUDIES OF COAL IN ASHOKA (OCP), PIPARWAR AREA OF NORTH KARANPURA COALFIELD, DISTRICT-CHATRA, JHARKHAND

A Synopsis submitted to the University Department of Geology, Ranchi University, Ranchi, Jharkhand for Ph.D. Registration.


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The topic of the research: Petro-Palynological studies of coal in Ashoka (OCP), Piparwar area of North Karanpura coalfield, District-Chatra, Jharkhand

## 1. STATE-OF-THE-ART:

India is the world's fastest-growing major economy and is expected to become the world's third largest economy in the coming years. With the rapid industrial growth, the need for energy has grown during the past ten years and will soon continue to do so. India's need for energy is growing annually, and the nation must rely primarily on coal to meet this demand. Currently, coal supplies around 60% of the world's commercial energy needs. Because coal is so abundant compared to the extremely limited resources of oil and natural gas, it is very significant to India's energy landscape. It will remain dominant as the main source of commercial energy until there is a greater reliance on renewable energy sources.

To meet the energy requirements of our nation, the Government has undertaken several initiatives to scale up domestic coal production. Therefore, as against the increased coal demand, domestic coal production has also increased. In 2022-23, the domestic coal production increased by 14.77% to reach 893.19 MT from 778.21 MT in 2021-22.

The Lower Gondwana coals are mostly found in three significant depositional basins in India: the Godavari Valley basins, the Son-Mahanadi Valley basins, and the Damodar-Koel Valley basins. The Damodar River basin spans the districts of Hararibagh, Ramgarh, Koderma, Giridih, Dhanbad, Bokaro, and Chatra in Jharkhand, with a catchment area of 25820 km. In comparison to the coal of the northern hemisphere, which belongs to the Carboniferous Period and formed from an autochthonous mode of deposition, Gondwana coal occurs in different coal bearing sequences of the Permian Period and is derived from drifted plant material deposited in basins or valleys i.e. the coal is allochthonous in nature (Krishnan, 1982, Navale, 1974, Navale, 1976, Navale, 1978). Karanpura coalfield, one of the major coal-bearing Gondwana basins in peninsular India extends for about 38 km in a north-south direction and 75 km in an east-west direction encompassing an area of about 2280 sq. km. North Karanpura has a total area of 1,224 sq. km. The Piparwar project was the first coal mine in the North Karanpura Coalfield. The total area allocated under coal blocks is 600.15 ha in NKCF (Central Mine Planning & Design Institute 2016).

## 1.1 LOCATION OF THE STUDY AREA:

The study area is the Ashoka coal mine, Piparwar area, Block-Tandwa, District-Chatra, North Karanpura coalfield, operated under CCL. The Ashoka is located at 23°43'31"N to 85°1'12"E. The Ashoka mine is connected to Ranchi by a metaled road via Khalari and to Hazaribagh via Barkagaon. The distance of the Project from Ranchi is about 80 Kms. The nearest Railway Station 'Ray', on the Gomoh- Dehri-On-Sone loop line of the Eastern Railway, is located about 10 km away from the project. The nearest airport, Birsa Munda Airport, is situated in Ranchi at about 60 km from the Kharari.

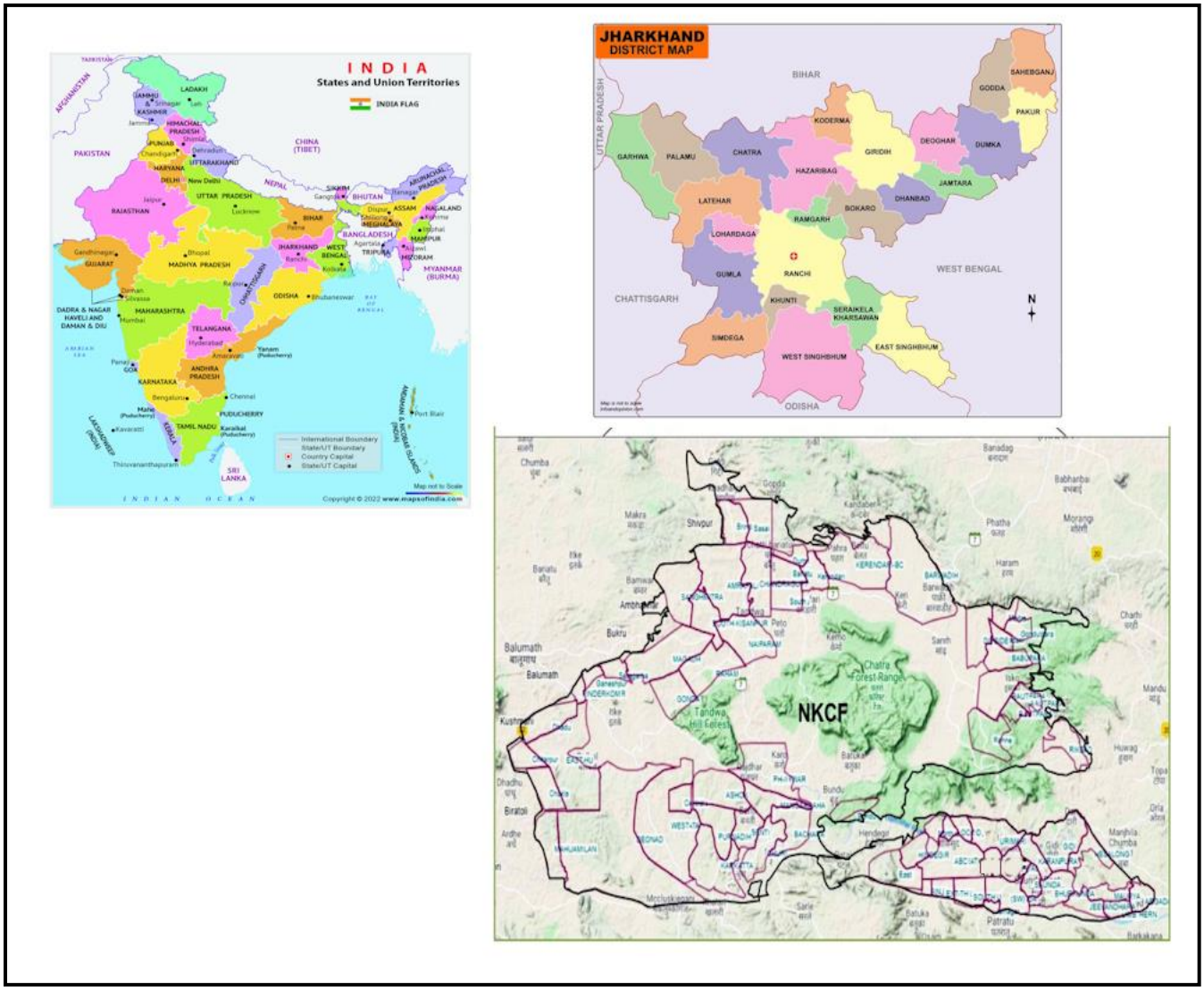


Figure *1.* Location map of the study area (Ashoka block, piparwar area, North Karanpura Coalfield

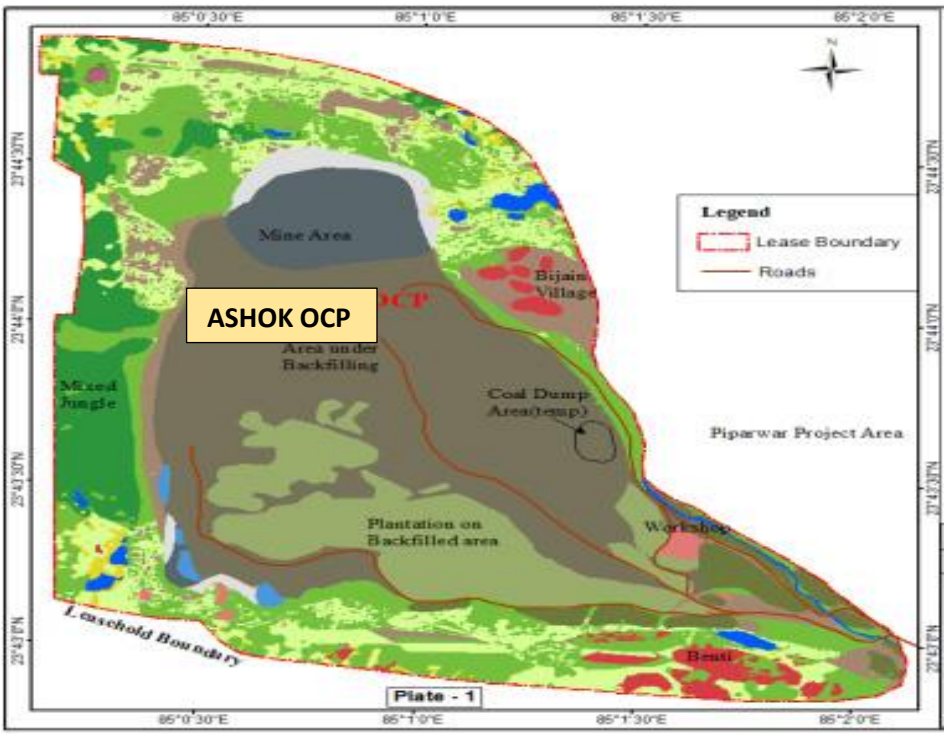


Figure 2. Ashoka OCP

## 1.2 Physiographic feature and Drainage pattern

The block is characterised by more or less flat terrain with gentle undulations. The general slope of the ground is towards the south. The ground elevation above MSL varies between 420m and 480m. A prominent physiographic feature 'Satohari Hill' (height 636m) lies in the north of the block. Two nallas, namely Dambua & Benti, originate from the area and join the Damodar River, which forms the main drainage channels of the area.

## 1.3 Climate and topography

The climatic conditions prevailing in the Ashoka mine have temperatures of 24◦C to 42◦C. the average annual rainfall is 152 cm. The main drainage pattern of the block is controlled by several tributaries of the Damodar River, flowing from north to south. The rivers are the tributaries of the Damodar River.

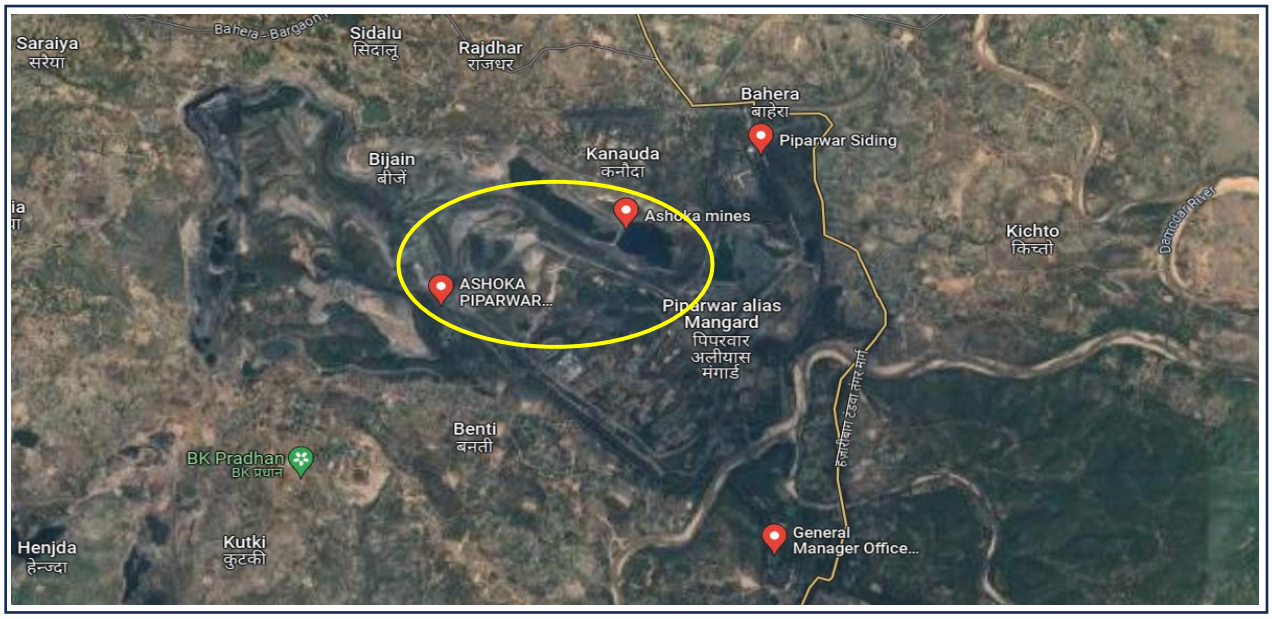


Figure 3. Satellite image of Ashoka OCP

## 1.4 GEOLOGY & STRATIGRAPHIC SEQUENCE:

The North Karanpura Coalfield forms a part of the east-west trending valley between the Hazaribagh plateau in the north and the Ranchi plateau in the south. A lengthy, east-west metamorphic stretch called the Aswa Pahar divides the South Karanpura Coalfield from the North Karanpura Coalfield. Nonetheless, a thin tongue of Talchir outcrops connects them almost entirely in the vicinity of Bachra and Hindgir settlements. A thin band of metamorphic rocks with many Talchir Formation outliers divides the North Karanpura Coalfield from the West Bokaro Coalfield on the eastern side. It is divided from the Auranga Coalfield in the west by a metamorphic zone that is roughly 20 km broad.

Table 1. represents the general stratigraphy of the study area (Ghosh et al., 1996; Sen and Banerjee, 2015), which lies between 23°43' N to 23°47' N and 84°47' E to 84°53' E falls under the CCL (Central Coal Fields Limited) command area of Palamau district and lies in the westernmost sector of the north Karanpura coalfield (NKF).

*Stratigraphic sequence of North Karanpura coalfield (modified after Ghosh et al., 1996; Sen and Banerjee, 2015)*

| Geological Age | Formation | Thickness (m) |
|---|---|---|
| | | |
| Tertiary | Clay,Sand | 8 - 17 |
| ----------Unconformity---------- | | |
| Permian | Barren Measure/Iron Stone Shale | 200 |
| | Barakar | 400 |
| | Talchir | Rarely encountered |
| ----------Unconformity---------- | | |
| Precambrian | Quartzite, micz schist | |

## 2. PROBLEM TO BE INVESTIGATED:

- To determine the rank of the coal.
- To analyse the detailed petrographic characteristics of coal.
- To study the microscopic spores and pollen preserved in coal.
- To determine the age of the fossil samples.
- To depict the depositional palaeoenvironment.

## 3. OBJECTIVE OF THE INVESTIGATION AND MOTIVATION:

- Determination of the rank of the coal.
- Determination of different properties of coal samples in the laboratory by Proximate and Ultimate analyses.
- To study the lithotype and maceral present in the rock.
- To date and correlate various coal seams the formation through the detailed study of palynomorphs.

- To interpret the vegetation cover to understand the physical and chemical changes in the coalification process.
- To analyse the paleoclimatic condition from the study of spores and pollens present in the coal.

## 4. HYPOTHESIS:

The petrographic examination of coal is an invaluable tool for the coal industry. It facilitates the appraisal of resources and coal exploration. Classification and commercialization of coal To complete the data analysis By examining the microscopic world of pollen and spores preserved in coal, scientists can learn important details about the climate, ecology, and geological settings that surrounded coal creation in the past. For the purposes of coal exploration, resource assessment, and comprehending the effects of coal use on the environment, this information is essential.

## 5. RESEARCH DESIGN & METHODOLOGY:

The Methodology and Research design of the study area will include :

Step 1 :

- Field survey
- Photography
- Cataloguing
- Literature survey
- Make arrangements for the collection of samples.

Step 2: Research analysis will be carried out in the following stages-

- Petrograghical study
- Collection and storage of fossils

- Microscopic study of fossils
- Palynological study
- Interpretation of data

## Petrographic study of coal:

The study will be done in the following stages –

Stage 1: Reduction of the quantity of coal sample (coning and quartering)

Stage 2: Grinding

Stage 3: Sieving

## Chemical analysis of coal:

Moisture, volatile matter, ash content and fixed carbon in coal will be determined by proximate analysis. The elemental constituents of the organic part of coal are carbon, nitrogen, hydrogen, sulphur, and oxygen and estimation of relative proportion is done through the ultimate analysis of coal.

## Palynological study of coal:

- The samples will be collected from different areas of the Rajmahal basin and will be appropriately catalogued, numbered and stored in the repository namely viz, Coal Laboratory, University Department of Geology, Ranchi University, Ranchi.

- All the collected samples will be prepared by different appropriate maceration techniques.

  Microspores will be recovered from the sediments by usual maceration techniques. About 5-7 g of the material from each sample was first treated with conc. Hydrofluoric acid for 2 days and then with commercial nitric acid for 3-4 days followed by treatment with 10% potassium hydroxide after thorough washing with water. The macerates will then be

mounted in Canada Balsam and the slide will be prepared, followed by photography (Bharadwaj & Salujha 1964), (Jha et al., 2007).

## 6. TOOLS TO BE USED IN THE COLLECTION OF DATA

| | |
|---|---|
| • Toposheet | • Chisels |
| • Handheld GPS | • Haversack or Plastic bags |
| • Clinometer compass | • Field notebook |
| • Hand Augur | • Brushes |
| • Palynological microscope | • Hand lens |

## 7. SIGNIFICANCE OF THE STUDY:

- The detailed microscopic study of a group of macerals will help determine the coal type and rank of coal.
- Classification of megafossils for determining age.
- Correlation and comparative study of coal seams.
- Study of distribution of macerals and mineral matter allows for optimizing coal processing methods like beneficiation to yield better quality coal products.

## 8. IT'S RELEVANCE TO THE PRESENT-DAY PROBLEM AND NEED TO SOCIETY:

In some developing countries, coal remains a vital resource for achieving electrification and economic growth, especially where alternative energy infrastructure is lacking. Studies on petrographical characteristics of coal will enlighten the significance of is quality of coal found in the Ashoka (OCP) mine. It will provide valuable information for efficient and sustainable coal

utilization. The petro-paleontological analysis will help in the comparative study of coal seams, infer a correlation and decipher the paleoenvironment condition. Palynomorhs will help understand the evolution of life, determining the age of various lower Gondwana sequences found in the Ashoka mine. It will give vivid information on paleoclimate.

## 9. CONTRIBUTION TO THE EXISTING KNOWLEDGE:

The comprehensive study of petrographic and chemical properties of the coal seam of Ashoka (OCP), piparwar area will assist in determining the coal quality, rank and potential for different uses. The study of fossils in the study area will contribute to the existing knowledge in a better understanding of paleoenvironment conditions. These studies will have a great impact on the effective utilization of coal.

## 10. FUTURE WORK:

In addition to the petrographic properties, the coal can be further categorised on the basis of type, rank and grade. Using the petrological data and organic geochemical data further work can be done to determine the hydrocarbon generation of coals. Based on these studies to determine its use in different processes, like carbonization, and liquefaction of coal in the study area. Research work on fossils will provide opportunities not only in the field of geology but also in the botany field of research. Further study on Study of the lithofacies and correlation coal seams will help to explain the disposition of the lateral and vertical facies.

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